

# Technical Information

CK6080WA

RELIABLE  
TWIN POWER TRIODE

The CK6080WA is a reliable, heater-cathode type, low- $\mu$ , twin power triode, suitable for operation as a regulator tube in DC power supplies. It is designed for service where conditions of high temperature and mechanical shock or vibration are encountered. Several CK6080WA tubes can be paralleled as desired for increased levels of current or power.

## MECHANICAL RATINGS:

|   |            |
|---|------------|
| Maximum Impact Acceleration (Shock)                     | 450 G      |
| Fatigue (Vibrational Acceleration for extended periods) | 2.5 G      |
| Maximum Bulb Temperature                                | 230 °C     |
| Altitude (Note A)                                       | 60,000 ft. |

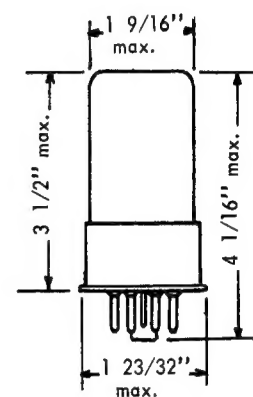
## ELECTRICAL DATA

| Ratings and Normal Operation                                      | MIL-E-1 Symbol     | Test Limit or Absolute Minimum | Normal Test Conditions | Normal Operation | Test Limit or Absolute Maximum | MIL-E-1 Units |
|---|--------------------|--------------------------------|------------------------|------------------|--------------------------------|---------------|
| Ratings   |                    |                                |                        |                  |                                |               |
| Heater Voltage  | Ef:                | 6.0                            | 6.3                    | ---              | 6.6                            | V             |
| Plate Voltage   | Eb:                | ---                            | 135                    | ---              | 250                            | Vdc           |
| Grid Voltage  | Ec:                | ---                            | 0                      | ---              | 0                              | Vdc           |
| Heater-Cathode Voltage (Note B)                                   | Ehk:               | -300                           | ---                    | ---              | +300                           | v             |
| Cathode Resistance (per cathode)                                  | Rk/k:              | ---                            | 250                    | ---              | ---                            | Ohms          |
| Grid Resistance (per grid) Note C                                 | Rg/g:              | ---                            | ---                    | ---              | ---                            | Meg.          |
| Grid Current (per grid)   | Ic/g:              | ---                            | ---                    | ---              | 5.0                            | mAdc          |
| Plate Dissipation (per plate)                                     | Pp/p:              | ---                            | ---                    | ---              | 13                             | W             |
| Tests   |                    |                                |                        |                  |                                |               |
| Heater Current  | If:                | 2.35                           | ---                    | ---              | 2.65                           | A             |
| Heater Cathode (Leakage $-(E_{hk} = \pm 100 \text{ Vdc})$ Note D) | Ihk:               | ---                            | ---                    | ---              | 25                             | $\mu$ Adc     |
| Plate Current (Notes D, E)  | Ib:                | 100                            | ---                    | 125              | 150                            | mAdc          |
| Transconductance (Notes D, E)                                     | Sm:                | 6,000                          | ---                    | 7,000            | 8,200                          | $\mu$ mhos    |
| Transconductance (2) (Notes D, E) Ef = 5.7V                       | $\Delta E_f S_m$ : | ---                            | ---                    | ---              | 10                             | %             |
| Plate Current (1) difference between sections                     | $\Delta I_b$ :     | ---                            | ---                    | ---              | 25                             | mAdc          |
| Amplification (Notes D, E)  | Mu:                | 1.5                            | ---                    | ---              | 2.5                            | ---           |

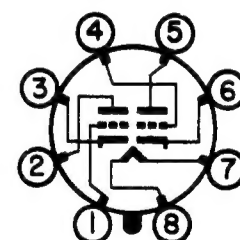
## MECHANICAL DATA

ENVELOPE ..... T-12 Glass  
BASE ..... B8-98  
CATHODE... Coated Unipotential  
BASING ..... 8BD  
MOUNTING POSITION ..... Any

## PHYSICAL DIMENSIONS



## BASING



## BOTTOM VIEW

## TERMINAL CONNECTIONS:

- Pin 1 Grid, Unit #2
- Pin 2 Plate, Unit #2
- Pin 3 Cathode, Unit #2
- Pin 4 Grid, Unit #1
- Pin 5 Plate, Unit #1
- Pin 6 Cathode, Unit #1
- Pin 7 Heater
- Pin 8 Heater



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| Ratings and<br>Normal Operations  | MIL-E-1<br>Symbol | Test<br>Limit<br>or<br>Absolute<br>Minimum | Normal<br>Test<br>Conditions | Normal<br>Operation | Test<br>Limit<br>or<br>Absolute<br>Maximum | MIL-E-1<br>Units |
|---|-------------------|--|------------------------------|---------------------|--|------------------|
| Tests   |                   |  |                              |                     |  |                  |
| Vibration (2)<br>Rp=2000;<br>Ec=-7 Vdc (Note F)<br>Rk=0;<br>f=25 cps; G=2.5 | Ep:               | ---  | ---                          | ---                 | 50   | mVac             |
| Plate Current (2)<br>Eb=250 Vdc;<br>Ec=-200 Vdc<br>(Notes D, E)             | Ib:               | ---  | ---                          | ---                 | 10   | mAdc             |

### SPECIAL TESTS AND RATINGS TO INSURE RELIABILITY.

Randomly selected statistical samples are subjected to the following tests:

|                               |  |
|-------------------------------|--|
| Shock Test -                  | 450G. 30° hammer angle in Navy high impact shock machine. Sample subjected to twenty impact accelerations, five impact accelerations in each of four different positions.  |
| Fatigue Test -                | 2.5G. Sample subjected to vibrational acceleration of 2.5G for 96 hours (32 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.   |
| Heater-Cycling<br>Life Test - | A sample is subjected to 2000 on-off heater cycles at the following conditions. Ef=7.5 V; Ehk=300 V and other elements floating. At the conclusion of this test the tubes will not show open heater or cathode circuits, heater-cathode shorts, or heater-cathode leakage current in excess of 50μAdc. |
| Stability Life Test -         | Sample is operated for one hour to assure initial electrical stability ( $\Delta_t$ , Sm < 10%). Tubes operated at room temperature ambient, RL = 125 Ω Rg/g = 1.0 meg; Ehk = 300 V.   |
| Survival Rate<br>Life Test -  | Sample is operated one hundred hours to assure electrical stability (Sm > 5800 μmhos) and freedom from inoperatives, at stability life test conditions.  |
| Intermittent<br>Life Test -   | 1000 hours. Sample is operated with minimum Envelope Temperature of 230°C. Tubes are operated at Rk = 125 ohms; Rg = 1.0 meg; Ehk = 300V.  |
| Altitude -                    | Sample is subjected to a pressure of 55±5 mmHg (60,000 ft.) at 500 Vac to assure freedom from flashover or corona at the pins of the tube.   |

### APPLICATION NOTES

**CAUTION -- To Electronic Equipment Design Engineers:** Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.



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Note A If altitude rating is exceeded, reduction of instantaneous voltages ( $E_f$ , excluded) may be required.

Note B The reference point for heater-cathode potentials shall be the positive terminal of the cathode resistor.

Note C Maximum grid-circuit resistance:

- (a) 1.0 megohm for Cathode-bias operation.
- (b) 0.1 megohm for fixed-bias operation.
- (c) 0.1 megohm for combined fixed and cathode-bias operation.

Note D Test each unit separately.

Note E Both units shall be operating.

Note F Tie 1k to 2k; 1g to 2g; and 1p to 2p.

### ACCEPTANCE CRITERIA

#### TEST CONDITIONS

The following tests shall be performed:

For the purposes of inspection, use applicable reliable paragraphs of MIL-E-1.

For miscellaneous requirements, see Paragraph 3.6.

Heater Voltage 6.3 V  
Plate Voltage 135 Vdc  
Grid Voltage 0 Vdc  
Cathode Resistance (per cathode) 250 ohms

| Ref.   | Test                                     | Conditions                                    | AQL<br>(Percent<br>Defective)                     | Inspection<br>Level or<br>Code | Symbol       | LIMITS<br>(See Note 2) |      |       |      |          |      | Units                  |
|--|--|---|---|--------------------------------|--------------|------------------------|------|-------|------|----------|------|------------------------|
|  |  |   |   |                                |              | Min                    | LAL  | Bogie | UAL  | Max      | ALD  |                        |
| QUALIFICATION APPROVAL TESTS (Note 19)         |  |   |   |                                |              |                        |      |       |      |          |      |                        |
| 3.1  | Qualification Approval:                  | Required for JAN Marking                      | ---   | ---                            | Ep:          | ---                    | ---  | ---   | ---  | 100      | ---  | mVac                   |
| 4.9.20.3                                       | Vibration (1):                           | Ecl = - 7Vdc;<br>Rp = 2000 ohms;<br>(note 13) | ---   | ---                            |              | ---                    | ---  | ---   | ---  | ---      | ---  |                        |
| ---  | Cathode:                                 | Coated Unipotential                           | ---   | ---                            |              | ---                    | ---  | ---   | ---  | ---      | ---  |                        |
| 3.4.3  | Base Connections:                        | B8-98   | ---   | ---                            |              | ---                    | ---  | ---   | ---  | ---      | ---  |                        |
| MEASUREMENTS ACCEPTANCE TESTS, PART 1 (Note 1) |  |   |   |                                |              |                        |      |       |      |          |      |                        |
| 4.10.8   | Heater Current:                          | Note 12<br>Ehk = + 100Vdc<br>Ehk = - 100Vdc   | 0.65  | II                             | If:          | 2.35                   | ---  | ---   | ---  | 2.65     | ---  | A                      |
| 4.10.15  | Heater-Cathode<br>Leakage:               |   | 0.65  | II                             | Ihk:<br>Ihk: | ---                    | ---  | ---   | ---  | 25<br>25 | ---  | $\mu$ Adc<br>$\mu$ Adc |
| 4.10.6.1                                       | † Grid Current:                          |   | Rg = 1.0 Meg.;<br>Rk = 125 ohms;<br>(notes 5, 13) | 0.65                           | II           | Ic:                    | 0    | ---   | ---  | ---      | -2.0 | ---                    |
| 4.10.4.1                                       | Plate Current (1):                       | (notes 12, 15)                                | 0.65  | II                             | Ib:          | 100                    | ---  | ---   | ---  | 150      | ---  | mAdc                   |
| 4.10.4.1                                       | Plate Current (1):                       | (notes 2, 12, 15)                             | ---   | ---                            | Ib:          | ---                    | 115  | 125   | 135  | ---      | 25   | mAdc                   |
| 4.10.9   | Transconductance (1):                    | (notes 12, 15)                                | 0.65  | II                             | Sm:          | 6000                   | ---  | ---   | ---  | 8200     | ---  | $\mu$ mhos             |
| 4.10.9   | Transconductance (1):                    | (notes 2, 12, 15)                             | ---   | ---                            | Sm:          | ---                    | 6600 | 7000  | 7400 | ---      | 1000 | $\mu$ mhos             |
| 4.7.5  | Continuity and Shorts:<br>(Inoperatives) |   | 0.4   | II                             |              | ---                    | ---  | ---   | ---  | ---      | ---  |                        |
| 4.9.1  | Mechanical:                              | Envelope: per outline                         | ---   | ---                            |              | ---                    | ---  | ---   | ---  | ---      | ---  |                        |



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| Ref.                                      | Test   | Conditions  | AQL<br>(Percent<br>Defective) | Inspection<br>Level or<br>Code | Symbol   | LIMITS<br>(See Note 2) |     |       |     |                               |     | Units  |
|---|--|---|-------------------------------|--------------------------------|--|------------------------|-----|-------|-----|-------------------------------|-----|--|
|   |  |   |                               |                                |  | Min                    | LAL | Bogie | UAL | Max                           | ALD |  |
| MEASUREMENTS ACCEPTANCE TESTS, PART 2     |  |   |                               |                                |  |                        |     |       |     |                               |     |  |
| 4.8                                       | Insulation of<br>Electrodes:                           | Eg-all = - 100 Vdc<br>Ep-all = - 300 Vdc<br>(note 12)   | 2.5                           | L6                             | R:<br>R:   | 200<br>200             | --- | ---   | --- | ---                           | --- | Meg<br>Meg                                       |
| 4.10.9                                    | Transconductance(2):                                   | Ef = 5.7V;<br>(notes 12, 15)  | 2.5                           | I                              | $\Delta_{Sm}$<br>Ef:                             | ---                    | --- | ---   | --- | 10                            | --- | %  |
| 4.9.12.1                                  | Low Pressure Voltage<br>Breakdown:                     | Pressure = 55 ± 5 mm Hg;<br>Voltage = 500 Vac;<br>(notes 3, 4)  | 6.5                           | Note<br>4                      | ---  | ---                    | --- | ---   | --- | ---                           | --- |  |
| 4.10.4.1                                  | Plate Current (1) Dif-<br>ference Between<br>Sections: |   | 2.5                           | I                              | Ib:  | ---                    | --- | ---   | --- | 25                            | --- | mAdc   |
| 4.10.11.1                                 | Amplification Factor:                                  | Rk = 250 ohms<br>(notes 12, 15)   | 6.5                           | Code<br>G                      | Mu:  | 1.5                    | --- | ---   | --- | 2.5                           | --- |  |
| 4.9.19.1                                  | Vibration (2):<br>(Low Frequency)                      | Rp = 2000; Ec = - 7Vdc;<br>(note 13)  | 6.5                           | Code<br>G                      | Ep:  | ---                    | --- | ---   | --- | 50                            | --- | mVac   |
| 4.10.4.1                                  | Plate Current (2):                                     | Eb = 250 Vdc;<br>Ec = - 200 Vdc;<br>(notes 12, 15)  | 2.5                           | I                              | Ib:  | ---                    | --- | ---   | --- | 10                            | --- | mAdc   |
| DEGRADATION RATE ACCEPTANCE TESTS, NOTE 7 |  |   |                               |                                |  |                        |     |       |     |                               |     |  |
| 4.9.20.5                                  | Shock:   | Hammer angle = 30°<br>Ehk = + 100 Vdc;<br>Ec = - 7 Vdc;<br>Rb = 2000 ohms; Rk = 0;<br>(notes 13, 20)  | ---                           | ---                            | ---  | ---                    | --- | ---   | --- | ---                           | --- |  |
| 4.9.20.6                                  | Fatigue:   | G = 2.5 min. Fixed Fre-<br>quency; F = 25 min. 60<br>max. Apply only Ef.  | 6.5                           | Note<br>4                      |  | ---                    | --- | ---   | --- | ---                           | --- |  |
| ---                                       | Post Shock and<br>Fatigue End Points:                  | Vibration (2)<br>Heater-Cathode Leakage<br>Ehk = + 100 Vdc<br>Ehk = - 100 Vdc<br>Change in Transconduct-<br>ance (1) of individual<br>tubes.<br>Grid Current: | ---                           | ---                            | Ep:<br>Ihk:<br>Ihk:<br>$\Delta_{Sm}$<br>↑<br>Ic: | ---                    | --- | ---   | --- | 100<br>50<br>50<br>10<br>-3.0 | --- | mVac<br>$\mu$ Adc<br>$\mu$ Adc<br>%<br>$\mu$ Adc |

| Ref.                          | Test  | Conditions  | AQL<br>(Percent<br>Defective) | Inspection<br>Level or<br>Code | Allowable Defectives<br>per Characteristic |                    | Sym.            | LIMITS |     | Units |
|-------------------------------|---|---|-------------------------------|--------------------------------|--|--------------------|-----------------|--------|-----|-------|
|                               |   |   |                               |                                | First<br>Sample                            | Combined<br>Sample |                 | Min    | Max |       |
| ACCEPTANCE LIFE TESTS, NOTE 7 |   |   |                               |                                |  |                    |                 |        |     |       |
| 4.11.3.1(a)                   | Stability Life Test:                        | Rk=125; Rg/g=1.0 Meg<br>Notes 10,11,13<br>Ehk=300V                      | 1.0                           | Code<br>I                      |  |                    | $\Delta_{Sm}$ : | ---    | 10  | %     |
| 4.11.4                        | Stability Life Test<br>End Points: (1 hour) | Change in Transconductance(I) of individual<br>tubes; Note 10           |                               |                                |  |                    |                 |        |     |       |
| 4.11.3.1(b)                   | Survival Rate Life<br>Test:                 | Notes 11,13,14,17<br>Stability Life Test<br>Conditions or<br>Equivalent |                               |                                |  |                    |                 |        |     |       |



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| Ref.                                   | Test  | Conditions   | AQL<br>(Percent<br>Defective) | Inspection<br>Level or<br>Code | Allowable Defectives<br>per Characteristic |                     | Sym.                      | LIMITS          |                  | Units                  |
|--|---|--|-------------------------------|--------------------------------|--|---------------------|---------------------------|-----------------|------------------|------------------------|
|  |   |  |                               |                                | First<br>Sample                            | Combined<br>Samples |                           | Min             | Max              |                        |
| ACCEPTANCE LIFE TESTS, NOTE 7 (Cont'd) |   |  |                               |                                |  |                     |                           |                 |                  |                        |
| 4.11.4                                 | Survival Rate Life<br>Test End Points:<br>(100 hours) | Inoperatives<br>Transconductance(1)  | 0.65<br>1.0                   | II<br>II                       | ---  | ---                 | Sm:                       | 5800            | ---              | $\mu$ mos              |
| 4.11.7                                 | Heater Cycling Life<br>Test:                          | Ef=7.5V; Ehk=300Vdc;<br>Eb=Ec=0; Note 8<br>1 min. on, 4 min. off                 |                               |                                |  |                     |                           |                 |                  |                        |
| 4.11.4                                 | Heater Cycling Life<br>Test End Points:               | Heater-Cathode Leakage<br>Ehk=+100Vdc<br>Ehk=-100Vdc<br>Note 8                   | ---<br>---                    | ---<br>---                     | ---<br>---                                 | ---                 | lhk:<br>lhk:              | ---<br>---      | 50<br>50         | $\mu$ Adc<br>$\mu$ Adc |
| 4.11.5                                 | Intermittent Life<br>Test                             | Rk=125 ohms; Rg=1.0<br>meg; Ehk=300V;<br>T Envelope=230°C<br>min.; Notes 9,13,16 | ---                           | ---                            | ---  | ---                 |                           | ---             | ---              |                        |
| 4.11.4                                 | Intermittent Life<br>Test End Points:<br>(1000 hours) | Notes 6,16<br>Inoperatives; Note 18<br>Grid Current<br>Transconductance(2)       | ---<br>---<br>---             | ---<br>---<br>---              | 1<br>1<br>1                                | 3<br>3<br>3         | Ic:<br>$\Delta$ Sm<br>Ef: | ---<br>0<br>--- | ---<br>-10<br>10 | $\mu$ Adc<br>%         |
|  |   | Combined Defectives  |                               |                                | 2  | 5                   |                           |                 |                  |                        |
|  |   | Heater-Cathode Leakage<br>Ehk=+100Vdc<br>Ehk=-100Vdc                             | ---<br>---                    | ---<br>---                     | 1<br>1                                     | 3<br>3              | lhk:<br>lhk:              | ---<br>---      | 25<br>25         | $\mu$ Adc<br>$\mu$ Adc |
|  |   | Heater Current   | ---                           | ---                            | 1  | 3                   | If:                       | 2.35            | 2.75             | A                      |
|  |   | Transconductance(1)  | ---                           | ---                            | 1  | 3                   | Sm:                       | 5500            | ---              | $\mu$ mos              |
|  |   | Insulation of Electrodes<br>g-all<br>p-all                                       | ---<br>---                    | ---<br>---                     | 1<br>1                                     | 3<br>3              | R:<br>R:                  | 100<br>100      | ---<br>---       | Meg<br>Meg             |
|  |   | Combined Defectives  |                               |                                | 3  | 6                   |                           |                 |                  |                        |
| PACKAGING REQUIREMENTS                 |   |  |                               |                                |  |                     |                           |                 |                  |                        |
| 4.9.18.1.1                             | Carton Drop:  | (d) Package Group 1;<br>Carton Size F  |                               |                                |  |                     |                           |                 |                  |                        |

Note 1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding Inoperatives and Mechanical shall be one (1) percent. A tube having one (1) or more defects shall be counted as one (1) defective. MIL-STD-105, Inspection Level II shall apply.

Note 2: Variables Sampling Procedure: See 4.1.1.7

Note 3: Low pressure voltage breakdown:- Tubes shall be tested in a chamber under the pressure specified. The specified voltage shall be applied between the base pins (or leads) of elements carrying B+ voltage and their adjacent pins (or leads). The voltage shall be of sinusoidal waveform with F = 60 cycles. Tubes showing evidence of arcing or corona shall be considered as defectives.

Note 4: This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. Once a lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lot shall be subjected to this test. MIL-STD-105, sample size code letter F shall apply.

Note 5: With both units operating, Ic is the sum of I1c and I2c.



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### NOTES: (Cont'd)

Note 6: Order for Evaluation of Life Test Defects. See 4.11.3.1.2.

Note 7: Destructive tests: Tubes subjected to the following destructive tests are not to be accepted under this specification.

4.9.20.5 Shock.

4.9.20.6 Fatigue

4.11.7 Heater-Cycling Life Test.

4.11.5 Intermittent Life Test.

Note 8: The no load to steady state full load regulation of the heater voltage supply shall be not more than 3.0 percent. This test shall be made on a lot by lot basis. A failure or defect shall consist of an open heater, open cathode circuit, heater-cathode short, or heater-cathode leakage current in excess of the specified heater cycling life test end point limit.

Note 9: Envelope Temperature is defined as the highest temperature indicated when using a thermocouple #40 BS or smaller diameter elements welded to a ring of .025 inch diameter phosphor bronze placed in contact with the envelope. Envelope Temperature requirement will be satisfied if tube, having bogie lb ( $\pm 5\%$ ) under normal test conditions, is determined to operate at minimum specified temperature at any position on the life test rack.

Note 10: Stability Life Test: See 20.2.5.1 of Appendix C.

Note 11: Tubes shall be life tested at room temperature ambient.

Note 12: Test each unit separately.

Note 13: Tie 1k to 2k; 1g to 2g; and 1p to 2p.

Note 14: For Survival Rate Life Test, the equivalent Stability Life-Test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

Note 15: Both units shall be operating.

Note 16: Intermittent Life Tests: See 20.2.5.3 of Appendix C.

Note 17: Survival Rate Life Test: See 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C.

Note 18: An inoperative as referenced in Life Test is defined as a tube having one (1) or more of the following defects: discontinuity (Ref. MIL-E-1, par. 4.7.1), shorts, (Ref. MIL-E-1, par. 4.7.2), air leaks.

Note 19: All tests listed hereon shall be performed during qualification inspection; however, these three tests are normally performed during qualification inspection only.

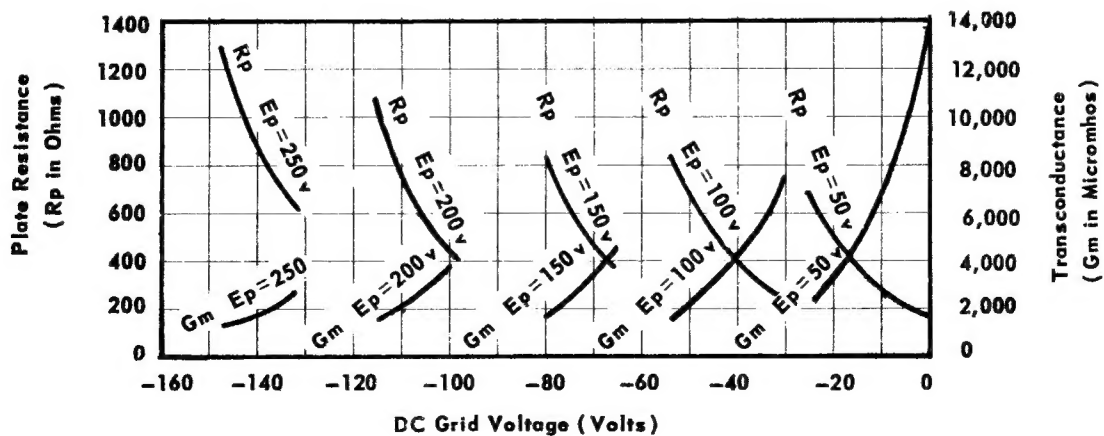
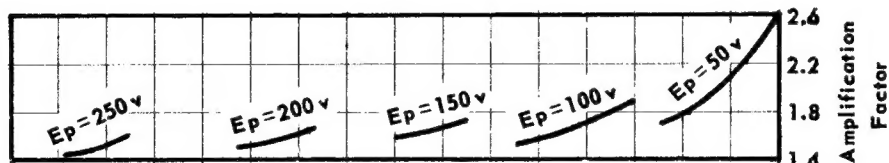
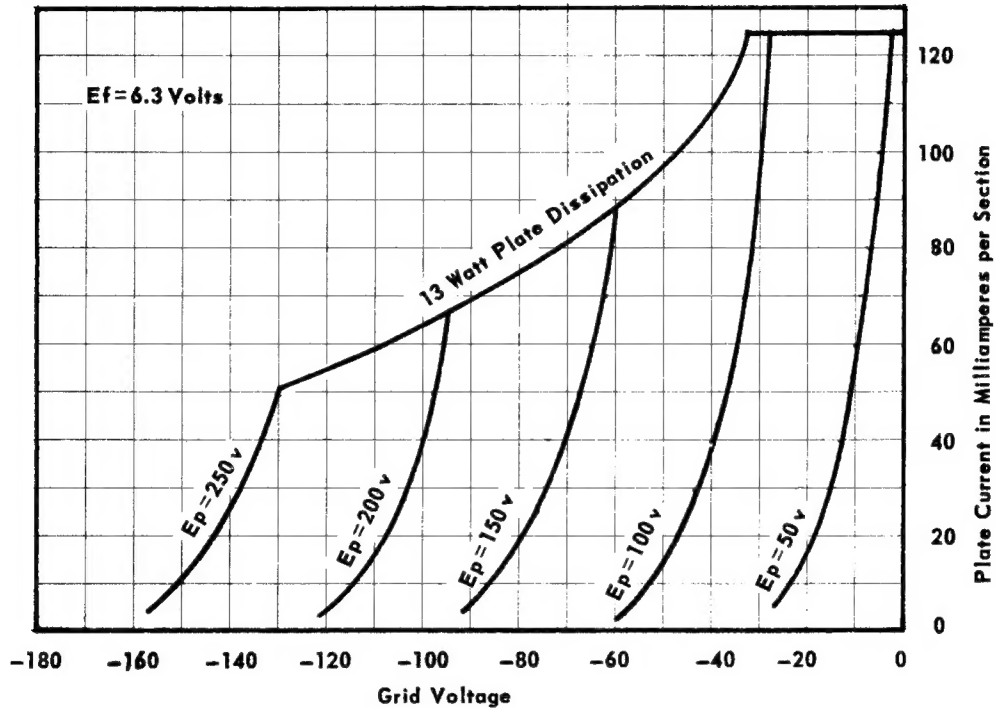
Note 20: A common grid resistor of 0.1 megohm shall be added; however, this resistor shall not be used when a thyratron-type short indicator is employed.



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## RELIABLE TWIN POWER TRIODE

TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION





CK6080WA

RELIABLE TWIN POWER TRIODE

PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

